WHAT IS CLAIMED IS:

1. A data transmission apparatus having maximum diversity gain in a mobile communication system including M transmission antennas, comprising:

P encoders for receiving P information bit streams and encoding the received P information bit streams with a space-time trellis code (STTC) according to an optimal generator polynomial;

M modulators for modulating P information bit streams output from the P encoders in a predetermined modulation scheme and outputting modulation symbol streams; and

M puncturers connected to the M transmission antennas, for puncturing at least one modulation symbol in a predetermined position from each of the modulation symbol streams output form the M modulators, and transmitting the punctured modulation symbol streams through the M transmission antennas.

2. The data transmission apparatus of claim 1, wherein for the modulation symbol streams output form the M modulators, the M puncturers each set a number of the at least one punctured modulation symbol to a same number.

3. The data transmission apparatus of claim 1, wherein the M puncturers each set the modulation symbol streams output from the M modulators so that a position where the at least one modulation symbol is punctured is periodically repeated.

4. The data transmission apparatus of claim 1, wherein if the M is 2 and a number of modulation symbols constituting the modulation symbol stream is 4, the position where the at least one modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1 = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element '0'.

5. The data transmission apparatus of claim 1, wherein if the M is 2 and the predetermined modulation scheme is binary phase shift keying (BPSK), the position where the at least one modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1 = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element '0'.

6. The data transmission apparatus of claim 1, wherein the optimal generator polynomial is a generator polynomial for enabling modulation symbol streams transmitted through the M transmission antennas to maintain the maximum diversity gain, and if a constraint length of the STTC is 4, the P encoders each use any one of the following generator polynomials as the optimal generator polynomial:

$g1 = 1 + D + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^2 + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D^2 + D^3$.

7. The data transmission apparatus of claim 1, wherein the optimal generator polynomial is a generator polynomial for enabling modulation symbol

streams transmitted through the M transmission antennas to maintain the maximum diversity gain, and if a constraint length of the STTC is 5, the P encoders each use any one of the following generator polynomials as the optimal generator polynomial:

$$g1 = 1 + D + D^2 + D^4,\ g2 = 1 + D + D^4$$

$$g1 = 1 + D^2 + D^3 + D^4,\ g2 = 1 + D + D^4$$

$$g1 = 1 + D + D^2 + D^3 + D^4,\ g2 = 1 + D + D^4$$

$$g1 = 1 + D + D^4,\ g2 = 1 + D + D^2 + D^4$$

$$g1 = 1 + D^3 + D^4,\ g2 = 1 + D + D^2 + D^4$$

$$g1 = 1 + D + D^2 + D^3 + D^4,\ g2 = 1 + D + D^2 + D^4$$

$$g2 = 1 + D + D^2 + D^4,\ g2 = 1 + D^3 + D^4$$

$$g1 = 1 + D^2 + D^3 + D^4,\ g2 = 1 + D^3 + D^4$$

$$g1 = 1 + D + D^2 + D^3 + D^4,\ g2 = 1 + D^3 + D^4$$

$$g1 = 1 + D + D^4,\ g2 = 1 + D^2 + D^3 + D^4$$

$$g1 = 1 + D^3 + D^4,\ g2 = 1 + D^2 + D^3 + D^4$$

$$g1 = 1 + D + D^2 + D^3 + D^4,\ g2 = 1 + D^2 + D^3 + D^4$$

$$g1 = 1 + D + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4$$

$$g1 = 1 + D + D^2 + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4$$

$$g1 = 1 + D^3 + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4$$

$$g1 = 1 + D^2 + D^3 + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4.$$

8. The data transmission apparatus of claim 1, further comprising a multiplexer for multiplexing the information bit streams and null data streams for trellis termination.

9. The data transmission apparatus of claim 8, wherein the multiplexer repeatedly outputs (K-1) null data streams after outputting (q-K) information bit streams for one frame, where K indicates a constraint length of the STTC and q indicates a number of columns of an error matrix incurring a loss of a diversity rank of the STTC.

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10. A data transmission method having maximum diversity gain in a mobile communication system including M transmission antennas, comprising the steps of:

receiving P information bit streams and encoding the received P information bit streams with a space-time trellis code (STTC) according to an optimal generator polynomial;

modulating the encoded P information bit streams in a predetermined modulation scheme and outputting M modulation symbol streams; and

puncturing at least one modulation symbol in a predetermined position from each of the M modulation symbol streams, and transmitting the punctured modulation symbol streams through M transmission antennas.

11. The data transmission method of claim 10, wherein for the M modulation symbol streams, a number of the at least one punctured modulation symbol is set to a same number.

12. The data transmission method of claim 10, wherein the M modulation symbol streams are set so that a position where the modulation symbol is punctured is periodically repeated.

13. The data transmission method of claim 10, wherein if the M is 2 and a number of modulation symbols constituting the modulation symbol stream is 4, the position where the modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1 = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element '0'.

14. The data transmission method of claim 10, wherein if the M is 2 and the predetermined modulation scheme is binary phase shift keying (BPSK), the position where the modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1 = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element '0'.

15. The data transmission method of claim 10, wherein the optimal generator polynomial is a generator polynomial for enabling modulation symbol streams transmitted through the M transmission antennas to maintain the maximum diversity gain, and if a constraint length of the STTC is 4, any one of the following generator polynomials is used as the optimal generator polynomial:

$g1 = 1 + D + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^2 + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D^2 + D^3$.

16. The data transmission method of claim 10, wherein the optimal generator polynomial is a generator polynomial for enabling modulation symbol streams transmitted through the M transmission antennas to maintain the maximum diversity gain, and if a constraint length of the STTC is 5, any one of the following generator polynomials is used as the optimal generator polynomial:

$g1 = 1 + D + D^2 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D^2 + D^3 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D + D^4$, $g2 = 1 + D + D^2 + D^4$

$g1 = 1 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^4$

$g2 = 1 + D + D^2 + D^4$, $g2 = 1 + D^3 + D^4$

$g1 = 1 + D^2 + D^3 + D^4$, $g2 = 1 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D^3 + D^4$

$g1 = 1 + D + D^4$, $g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D^3 + D^4$, $g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D^2 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$.

17. The data transmission method of claim 10, further comprising the step of multiplexing the information bit streams and null data streams for trellis termination.

18. The data transmission method of claim 17, wherein the multiplexing step comprises the step of repeatedly outputting (K-1) null data streams after outputting (q-K) information bit streams for one frame, where K indicates a constraint length of the STTC and q indicates the number of columns of an error matrix incurring a loss of a diversity rank of the STTC.

19. A data reception apparatus having maximum diversity gain in a mobile communication system, which receives through M reception antennas transmission symbol streams transmitted through N transmission antennas from a transmitter, the apparatus comprising:

a channel estimator connected to the M reception antennas, for channel-estimating reception symbol streams output from the M reception antennas;

P encoders for encoding all information bit streams that the transmitter can transmit with a space-time trellis code (STTC) according to a predetermined optimal generator polynomial;

M modulator for modulating information bit streams output from the P encoders in a predetermined modulation scheme and outputting modulation symbol streams;

M puncturers connected to the M transmission antennas, for puncturing at least one modulation symbol in a predetermined position from each of the modulation symbol streams output from the M modulators; and

a transmission symbol stream detector for detecting transmission symbol streams transmitted from the transmitter by using a hypothetic channel output when the modulation symbol streams output from the M puncturers are

transmitted through a same channel as a channel estimated by the channel estimator, and the reception symbol streams.

20. The data reception apparatus of claim 19, wherein for the modulation symbol streams output from the M modulators, the M puncturers each set a number of the at least one punctured modulation symbols to a same number.

21. The data reception apparatus of claim 19, wherein the M puncturers each set the modulation symbol streams output form the M modulators so that the position where the at least one modulation symbol is punctured is periodically repeated.

22. The data reception apparatus of claim 19, wherein if the M is 2 and a number of modulation symbols constituting the modulation symbol stream is 4, the position where the at least one modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1=\begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element ‘0’.

23. The data reception apparatus of claim 19, wherein if the M is 2 and the predetermined modulation scheme is binary phase shift keying (BPSK), the position where the at least one modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1=\begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element '0'.

24. The data reception apparatus of claim 19, wherein the optimal generator polynomial is a generator polynomial for enabling the modulation symbol streams to maintain the maximum diversity gain, and if a constraint length of the STTC is 4, the P encoders each use any one of the following generator polynomials as the optimal generator polynomial:

$g1 = 1 + D + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^2 + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D^2 + D^3$.

25. The data reception apparatus of claim 19, wherein the optimal generator polynomial is a generator polynomial for enabling the modulation symbol streams to maintain the maximum diversity gain, and if a constraint length of the STTC is 5, the P encoders each use any one of the following generator polynomials as the optimal generator polynomial:

$g1 = 1 + D + D^2 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D^2 + D^3 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D + D^4$, $g2 = 1 + D + D^2 + D^4$

$g1 = 1 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^4$

$g2 = 1 + D + D^2 + D^4$, $g2 = 1 + D^3 + D^4$

$g1 = 1 + D^2 + D^3 + D^4,\ g2 = 1 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4,\ g2 = 1 + D^3 + D^4$

$g1 = 1 + D + D^4,\ g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D^3 + D^4,\ g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4,\ g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D^3 + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D^2 + D^3 + D^4,\ g2 = 1 + D + D^2 + D^3 + D^4$.

26. The data reception apparatus of claim 19, wherein the transmission symbol stream detector comprises:

a hypothesis part for generating a hypothetic channel output when the modulation symbol streams output form the M puncturers were transmitted through a same channel as a channel estimated by the channel estimator;

a metric calculator for calculating a distance between the hypothetic channel output and the reception symbol streams; and

a minimum distance selector for detecting a reception symbol stream having a minimum distance among distances between the hypothetic channel output and the reception symbol streams as a transmission symbol stream transmitted from the transmitter.

27. The data reception apparatus of claim 19, further comprising a multiplexer for multiplexing the information bit streams and null data streams for trellis termination.

28. The data reception apparatus of claim 27, wherein the multiplexer repeatedly outputs (K-1) null data streams after outputting (q-K) information bit streams for one frame, where K indicates a constraint length of the STTC and q indicates the number of columns of an error matrix incurring a loss of a diversity rank of the STTC.

29. A data reception method having maximum diversity gain in a mobile communication system, which receives through M reception antennas transmission symbol streams transmitted through N transmission antennas from a transmitter, the method comprising the steps of:

channel-estimating reception symbol streams output from the M reception antennas;

encoding all information bit streams that the transmitter can transmit with a space-time trellis code (STTC) according to a predetermined optimal generator polynomial;

modulating the encoded information bit streams in a predetermined modulation scheme and outputting modulation symbol streams;

puncturing at least one modulation symbol in a predetermined position from each of the modulation symbol streams; and

detecting transmission symbol streams transmitted from the transmitter by using a hypothetic channel output when the punctured modulation symbol streams were transmitted through a same channel as the channel-estimated channel, and the reception symbol streams.

30. The data reception method of claim 29, wherein for the modulation symbol streams, a number of the at least one punctured modulation symbols is set to a same number.

31. The data reception method of claim 29, wherein the modulation symbol streams are set so that the position where the at least one modulation symbol is punctured is periodically repeated.

32. The data reception method of claim 29, wherein if the M is 2 and a number of modulation symbols constituting the modulation symbol stream is 4, the position where the at least one modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1=\begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element '0'.

33. The data reception method of claim 29, wherein if the M is 2 and the predetermined modulation scheme is binary phase shift keying (BPSK), the position where the at least one modulation symbol is punctured is determined according to a puncturing matrix P_1 given by

$$P_1=\begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \end{bmatrix}$$

where a column corresponds to a transmission period, a row corresponds to a transmission antenna, and the at least one modulation symbol is punctured in a position of an element '0'.

34. The data reception method of claim 29, wherein the optimal generator polynomial is a generator polynomial for enabling the modulation symbol streams to maintain the maximum diversity gain, and if a constraint length of the STTC is 4, any one of the following generator polynomials is used as the optimal generator polynomial:

$g1 = 1 + D + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^2 + D^3$, $g2 = 1 + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D + D^3$

$g1 = 1 + D^3$, $g2 = 1 + D^2 + D^3$.

35. The data reception method of claim 29, wherein the optimal generator polynomial is a generator polynomial for enabling the modulation symbol streams to maintain the maximum diversity gain, and if a constraint length of the STTC is 5, any one of the following generator polynomials is used as the optimal generator polynomial:

$g1 = 1 + D + D^2 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D^2 + D^3 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D + D^4$

$g1 = 1 + D + D^4$, $g2 = 1 + D + D^2 + D^4$

$g1 = 1 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^4$

$g2 = 1 + D + D^2 + D^4$, $g2 = 1 + D^3 + D^4$

$g1 = 1 + D^2 + D^3 + D^4$, $g2 = 1 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D^3 + D^4$

$g1 = 1 + D + D^4$, $g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D^3 + D^4$, $g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^3 + D^4$, $g2 = 1 + D^2 + D^3 + D^4$

$g1 = 1 + D + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D + D^2 + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$

$g1 = 1 + D^2 + D^3 + D^4$, $g2 = 1 + D + D^2 + D^3 + D^4$.

36. The data reception method of claim 29, further comprising the step of multiplexing the information bit streams and null data streams for trellis termination.

37. The data reception method of claim 36, wherein the multiplexing step comprises the step of repeatedly outputting (K-1) null data streams after outputting (q-K) information bit streams for one frame, where K indicates a constraint length of the STTC and q indicates the number of columns of an error matrix incurring a loss of a diversity rank of the STTC.